

Findings of the Scientific Review Panel on  
THE REPORT ON 1,3-BUTADIENE  
As Adopted at the Panel's March 19, 1992 Meeting

In accordance with the provisions of Health and Safety Code Section 39661, the Scientific Review Panel (SRP) has reviewed the report ("Proposed Identification of 1,3-Butadiene as a Toxic Air Contaminant") of the staffs of the Air Resources Board (ARB) and the Office of Environmental Health Hazard Assessment (OEHHA) on the public exposure to, and health effects of 1,3-butadiene. The Panel also reviewed the public comments received on this report. Based on this review, the SRP finds that the report on 1,3-butadiene is without serious deficiencies and agrees with the staffs of the ARB and OEHHA that:

1. There is evidence that exposure to 1,3-butadiene results in carcinogenicity. The International Agency for Research on Cancer (IARC), the United States Environmental Protection Agency (US EPA), and the U.S. Occupational Safety and Health Administration (OSHA) have found that 1,3-butadiene causes cancer in animals. The IARC and the US EPA have classified 1,3-butadiene as a possible (Group 2B) and probable (Group B2) human carcinogen, respectively, on the basis of sufficient evidence for carcinogenicity in animals and inadequate evidence in humans. However, it is our understanding that, based on three recent epidemiology studies, the IARC will upgrade its human evidence evaluation to "limited" this year, and categorize 1,3-butadiene as a probable (Group 2A) human carcinogen. The OSHA has found that exposure to 1,3-butadiene is associated with an increased risk of death from cancer of the lymphohematopoietic system, and has classified 1,3-butadiene as a potential occupational carcinogen.
2. Because 1,3-butadiene is listed as a hazardous air pollutant under Section 112 of the United States Clean Air Act of 1990, identification of 1,3-butadiene as a toxic air contaminant is required by the California Health and Safety Code Section 39655.
3. Based on available scientific information, a level of 1,3-butadiene exposure below which no carcinogenic effects are anticipated cannot be identified.
4. Based on a health protective interpretation of the available scientific evidence, the upper bound of the lifetime excess cancer risk resulting from 1,3-butadiene exposure ranges from  $9.8 \times 10^{-6}$  to  $8 \times 10^{-4}$  per ppb [ $4.4 \times 10^{-6}$  to  $3.6 \times 10^{-4}$  per microgram per cubic meter ( $\mu\text{g}/\text{m}^3$ )]. This range of risk is based on data from studies in rats and mice. The best value of the upper bound of risk is  $3.7 \times 10^{-4}$  per ppb ( $1.7 \times 10^{-4}$  per  $\mu\text{g}/\text{m}^3$ ). This value is based on data from a recent bioassay in mice. Appendix I compares the best value of the upper bound 1,3-butadiene cancer unit risk with those of other compounds reviewed by the SRP. These 95 percent upper bound lifetime risk estimates are health-protective estimates; the actual risk may be much lower.

5. Mobile sources (both on- and off-road) are responsible for the majority of the identified emissions of 1,3-butadiene. Mobile sources that do not have a functioning exhaust catalyst emit far greater amounts of 1,3-butadiene than do mobile sources with functioning catalysts. Stationary sources contribute to ambient concentrations of 1,3-butadiene during petroleum refining, fuel combustion, production of certain chemicals, and the manufacturing of styrene-butadiene copolymer products.
6. Based on data collected by the ARB's ambient toxic air contaminant monitoring network from 1988 through 1989, the estimated mean annual population-weighted outdoor ambient exposure for California is 0.37 ppbv ( $0.82 \mu\text{g}/\text{m}^3$ ).
7. Based on the ARB emission inventory, areas that may be expected to have 1,3-butadiene levels higher than the mean statewide concentration are near facilities using 1,3-butadiene for the production of resins and polymers, synthetic rubber manufacturing facilities, chemical production facilities, petroleum refineries, stationary fuel combustion sources, and congested freeways. New data from the AB2588 Air Toxics "Hot Spots" emissions reporting program should be used to evaluate "hot spot" exposures if 1,3-butadiene is identified as a toxic air contaminant.
8. Based on its gas-phase reactivity with the hydroxyl radical, ozone, and the nitrate radical, 1,3-butadiene's estimated tropospheric lifetime ranges from a few hours to about 12 hours.
9. Limited indoor monitoring for 1,3-butadiene indicates that individuals exposed to indoor environmental tobacco smoke (ETS) are almost certainly exposed to higher concentrations of 1,3-butadiene indoors than outdoors. The estimated dose for an individual spending three hours in an ETS environment is 10 to 60  $\mu\text{g}$ . The same individual, spending three hours in outdoor air at the statewide average 1,3-butadiene concentration of 0.37 ppbv ( $0.82 \mu\text{g}/\text{m}^3$ ), will experience an estimated dose of 2.6  $\mu\text{g}$ .
10. Studies of mice exposed to ppm concentrations of 1,3-butadiene indicate that 1,3-butadiene is taken up rapidly by the body and distributed with metabolites to all tissues. This distribution can result in cancer in multiple sites, including the heart, lung, mammary gland, ovaries, forestomach, liver, pancreas, thyroid, testes, and hematopoietic system. Exposure to 1,3-butadiene at higher concentrations ( $\geq 1,000$  ppm) is associated with tumors in the rat. Although it is not included in the calculations for the risk assessment, it is important to note that 1,3-butadiene is one of only two chemicals (the other being the fungicide Captafol) known to induce cancer in the heart of laboratory animals.
11. Epidemiological studies of production workers exposed to 1,3-butadiene provide limited evidence of an increased risk of death from hematologic neoplasms, especially leukemia and other lymphomas. Adverse health effects other than cancer are not expected to occur at mean statewide outdoor ambient concentrations.
12. Based on the OEHHA staff's best value cancer unit risk of  $3.7 \times 10^{-4}$  per ppb ( $1.7 \times 10^{-4}$  per  $\mu\text{g}/\text{m}^3$ ), and the ARB staff's population-weighted outdoor ambient exposure of 0.37 ppbv ( $0.82 \mu\text{g}/\text{m}^3$ ), up to 140 potential excess cancers per million are predicted if exposed to this level over a

70 year lifetime. This corresponds to an excess cancer burden of up to 4,200 cancers statewide (based on a population of 30 million people).

13. Based on the available scientific evidence, we conclude that 1,3-butadiene should be identified as a toxic air contaminant.

For these reasons, we agree with the ARB staff recommendation to its Board that 1,3-butadiene be listed by the ARB as a toxic air contaminant.

I certify that the above is a true and correct copy of the findings adopted by the Scientific Review Panel on March 19, 1992



Dr. James N. Pitts, Jr.  
Chairman, SRP